PERMIT MODULE XIV
MNA-BASED AND METALS ATTENUATION BASED CORRECTIVE ACTION 9 VAC 20-81-260

XIV.A. PURPOSE

This Module describes the requirements applicable to the remedial technology implemented on site as a result of an exceedance of groundwater protection standards (GPS).

The following permit documents outline the proposed remediation:

- Corrective Action Plan
- Corrective Action Groundwater Monitoring Plan
- Monitoring Well Installation Schedule
- Surface Water Sampling Plan

XIV.B. INTERIM MEASURES

At any time during the Corrective Action process, the Permittee or Director may determine that interim measures are required. Nothing in this Permit shall preclude the Permittee from performing interim measures at any time if required to reduce or eliminate the risk to human health and the environment, as long as the interim measures are consistent with the goal(s) of the Corrective Action Plan. If interim measures are required by the Director, the Permittee will respond with a plan for interim measures within 60 days of the Director's notification of the need for the requirement.

XIV.C. REMEDY REQUIREMENTS

The remedy applied to the impacted aquifer shall be able to meet each of the criteria defined under 260.C.3.c.(1).

XIV.D. REMEDY DESCRIPTION

Monitored Natural Attenuation (MNA) may be appropriate for implementation in those instances where source control is in place, current trends in groundwater quality are acceptable and display evidence of biologic attenuation of the contaminant mass, the plume remains within the permitted facility boundary or off-site impacted landowners agree with its use, there is no risk to receptors on off-site property(ies) and no evidence of any current or expected cross-media transfer of groundwater contaminants to surface waters.

In those cases where GPS exceeding constituents are solely metals, it may be possible to implement a groundwater remedy based on the long term monitoring of geochemical parameters in the aquifer. Metal transport is often contingent upon whether or not the metal is in an 'oxidized' or 'reduced' state. This condition will be governed by the

presence or absence (anoxic or reducing conditions) of free oxygen within the groundwater – as well as other reactants such as nitrate, ferric iron, and ferrous iron. In such cases, the mobility of a metal may be controlled either by natural means, or the use of a chemical catalyst/oxidant, and such controls may be successful in achieving GPS. For this case, the facility will be relying on NATURAL IN SITU PROCESSESS coupled with *Long Term Performance* (LTP) monitoring.

XIV.E. REMEDY IMPLEMENTATION

XIV.E.1. Implementation of the Corrective Action Plan and its related monitoring program begins on the date the Permit is amended to incorporate this Permit Module.

XIV.E.2. If any remedy components are not in place at the time this permit is issued:

XIV.E.2.a. the Corrective Action Plan shall contain a schedule which details each phase of the remedy implementation [260.D.1.b],

XIV.E.2.b. during the schedule period, the Permittee shall provide to the Director, updates every 30 days during the site preparation and installation phase of any remedy component installed after permit issuance [260.D.1.b.(8).a],

XIV.E.2.c. design plans for any remedy component should be submitted for Department review no less than 180-days prior to component installation.

XIV.E.3. If any condition causes a delay in the completion of the implementation schedule as outlined in the Corrective Action Plan, the Permittee must notify the Director of the problem within 7-days of recognizing the delay and amend the schedule accordingly.

XIV.E.4. Any changes in the implementation of the remedy design or groundwater monitoring program will require a modification to the facility's Permit.

XIV.E.5. The Director has the authority to modify the Permit for any changes to Corrective Action if any conditions of 600.E.5 or E.8, and 260.G.2 are found to be applicable.

XIV.F. ALTERNATE REMEDY PROVISIONS

Monitored Natural Attenuation (MNA) and long-term performance monitoring (LTP) have been selected as the remedy of choice on site.

The Permittee or Director may determine, based on information obtained after Corrective Action has been implemented, that compliance with the requirements of 260.C.3.c.(1)

are not being achieved by the remedy selected. In such cases, the Permittee shall, within 90-days of the determination:

XIV.F.1. unless the alternate remedy is already described in the Corrective Action Plan, submit a revised Corrective Action Plan describing the alternate remedy for Department review,

XIV.F.2. if the alternate remedy is already described in the existing Corrective Action Plan, submit any detailed design plans or monitoring component changes to the Department for review,

XIV.F.3. modify the facility's Permit to implement an alternate remedy, unless the Permittee submits and receives Director approval for the demonstration allowed under 260.G.3.

XIV.G. REMEDY PERFORMANCE MONITORING

The permittee shall operate and maintain the groundwater monitoring wells on site as specified below, in a manner which at a minimum meets the requirements of 250.A.3.e and 260.D.1.c. Unless otherwise specified, the upgradient well as listed in Module XI shall act as the upgradient well for groundwater remediation sampling purposes as well.

GPS Exceeding Compliance Well(s)	The Associated Performance Well(s)	The Associated Sentinel Well(s)
MW-5	M-1, P-2	S-2[1]
MW-13	NE-9	S-1[1]
NE-6	NE-D, NE-4, NE-9	S-2[1]
P-3R	MW-16	S-1[1]

Notes:

1. This is a surface water monitoring point that serves the purpose of a corrective action point (sentinel). Refer to Module XIV.P for additional information on surface water monitoring.

The groundwater remediation effort shall be coupled with a monitoring system designed, capable, and operated to demonstrate:

XIV.G.1. the areal extent (both vertical and horizontal) of the plume at concentrations which exceed background [260.D.1.c.(2)]. Because both the horizontal and vertical aspects of the plume must be monitored, the well network must include wells installed to a depth appropriate to intersect all groundwater flow paths in the aquifer.

XIV.G.2. the effectiveness of the implemented Corrective Action Program [260.D.1.c.(3)].

XIV.G.3. compliance with groundwater protection standards [260.D.1.c.(4)].

XIV.G.4. whether the plume has expanded (and remains onsite) since remedy implementation.

XIV.G.5. in the case of MNA use, successful biologic destruction of the waste mass.

XIV.G.6. in the case of metals, successful geochemical changes in the aquifer which retard metals transport in groundwater.

XIV.H. WELL NETWORK

XIV.H.1. Because both the horizontal and vertical aspects of the plume must be monitored, the well network must include wells installed to a depth which will intersect all groundwater flow paths.

XIV.H.2. The permittee shall operate and maintain the Corrective Action groundwater monitoring wells on site in a manner which is at a minimum, meets 250.A.3.e and allows the network to be operated as designed for the length of the Corrective Action Program.

XIV.H.3. Any new wells installed on site shall be constructed meeting the requirements of EPA's RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD).

XIV.H.4. The Director must be notified prior to the abandonment of any site wells utilized during Corrective Action. Wells shall be abandoned following the general requirements of EPA's RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) and a well abandonment report shall be transmitted under signature of a qualified groundwater professional to the Department within 30-days of completion of field activities.

XIV.H.5. *Upgradient wells* are those which provide site-specific background data as required under 250.A.3.a.(1).

XIV.H.6. *Compliance wells* are those which determine whether the landfill has impacted groundwater quality at the waste management unit boundary as required by 250.A.3.a.(2).

XIV.H.7. *Sentinel wells* are those which ensure there is no expansion of the plume or impact to sensitive receptors as a result of changes in plume migration post remedy implementation. These wells should intercept groundwater which shows no impact over background such that the data obtained from them can assist in delineating the full extent of the landfill-impacted groundwater. For organics, no impact means concentrations less than the limit of detection

(LOD).

XIV.H.8. *Performance wells* are those which measure or quantify the success of the remedy implemented. These wells, installed downgradient of each GPS exceeding well, should intercept groundwater which displays GPS exceedances. Data obtained from these wells is used to draw a line around that portion of the aquifer which continues to exceed GPS and thus require remediation.

XIV.H.9. Sentinel and Performance wells must be located along the same groundwater flow path as the corresponding impacted compliance well. EPA (1999) has previously stated that any inferences about attenuation based on apparent decreases in contaminant concentrations in the downgradient direction will likely be incorrect unless wells are located along the downgradient groundwater flow path and monitored at the appropriate frequency.

XIV.H.10. For sites implementing MNA, the Sentinel and Performance wells shall be positioned in a manner which allows providing the data defined by USEPA (1999) as being required to measure the progress or effectiveness of MNA-based remediation (USEPA, 2004). The data required by USEPA includes that which: (1) demonstrates MNA is occurring as expected, (2) can detect any changes in the geochemistry of the aquifer which may hinder MNA effectiveness, (3) identify any MNA breakdown products, (4) verifies the plume is not expanding either vertically or horizontally, (5) verifies no unacceptable impact to on site or off site receptors, (6) can detect any new releases to the environment, (7) can demonstrate the effectiveness of any institutional controls put in place to protect potential receptors, and (8) verifies clean-up goals have been met.

XIV.H.11. For metals CoC only sites, the Sentinel and Performance wells shall be positioned in a manner consistent with providing data required to measure the progress or effectiveness of the aquifer geochemistry in reducing the metals concentrations to GPS levels. The aquifer data required to demonstrate speciation includes that which: (1) demonstrates the oxidation state of the aquifer within the plume of contamination and at the 'precipitation/oxidation' boundary, (2) can measure the relationship of other aquifer parameters in assisting or hindering chemical speciation (i.e. nitrate, ferric iron, ferrous iron, pH, etc.), (3) identify the speciation forms of the metal in question, (4) verifies the plume is not expanding either vertically or horizontally, (5) verifies no unacceptable impact to on site or off site receptors, (6) can detect any new releases to the environment, and (7) verifies clean-up goals have been met.

XIV.I. MONITORING CONSTITUENTS

XIV.I.1. The permittee shall monitor all wells utilized during the Corrective Action Program for the constituents and frequencies defined in the tables below.

Other wells on site shall be monitored as required under Permit Modules X and XI.

GPS Constituents of Concern (COC) are defined as any constituent on the Table 3.1 Column B sampling list which has been identified at concentrations which exceed its respective GPS. Daughter Products are defined as any constituent resulting from the biodegradation of a COC.

Monitoring Well Type	Monitoring Frequency	Constituent List	Compare Results To
Performance Wells	Semi-annually	GPS COC, plus Daughter Products, MNA Performance Parameters, and LTP Monitoring Parameters	GPS
Sentinel Wells	Semi-annually	GPS COC, Daughter Products	GPS

MNA Performance Parameters, and the purpose they serve, are listed in the table below. To make comparisons appropriate for the understanding of the MNA process, these parameters may need to be added to the sampling list at the site background and downgradient compliance well.

Depleted Electron Acceptors	Metabolic By-Products	Miscellaneous
Dissolved Oxygen (DO)	Iron II	ORP
Nitrate	Methane	TOC
Sulfate	Chloride	pH
	Alkalinity	Conductivity
		Temp

LTP Parameters, and the purpose they serve, are listed in the table below. To make comparisons appropriate for the understanding of the MNA process, these parameters may need to be added to the sampling list at the site background and downgradient compliance well.

Electron Donors or Acceptors	Miscellaneous
Dissolved Oxygen (DO)	ORP
Nitrate	TOC
Sulfate	pH
Iron II	Conductivity
Iron III	Temperature

XIV.I.2. For the purposes of corrective action groundwater sampling:

XIV.I.2.a. the semi-annual sampling period shall be 180 days plus or minus 30 days between sampling events unless authorized by the Director,

XIV.I.2.b. the annual sampling period shall not exceed 360 days between sampling events unless authorized by the Director, and

XIV.I.2.c. the quarterly sampling period shall not exceed 90 days between sampling events unless authorized by the Director.

XIV.I.3. Constituent Detects - Refers to any constituent found above the laboratory limit of detection (LOD) during any sampling event.

XIV.I.4. If a Permittee employs verification sampling, the alpha value shall be modified as outlined in the Department's most recent technical memorandum for Data Analysis Guidelines for Solid Waste Facilities. Such samples shall be obtained within the timeframe defined under 250.A.4.h.(2). Verification sampling events conducted outside this timeframe, but within the compliance period, may be submitted in the form of an Alternate Source Demonstration meeting the requirements of 250.A.5.

XIV.J. REMEDY PERFORMANCE DEMONSTRATIONS

XIV.J.1. *Corrective Action Site Evaluations* (CASE)
A report titled Corrective Action Site Evaluation (CASE) shall be submitted to the Director, with a copy provided under separate cover to the Public Data Repository, once every three years, due on the calendar date the Permit was amended to implement the chosen remedy. The Permittee shall utilize the Department's *Submission Instructions* for CASE reports (2012 as amended) when putting together the CASE report for submission.

The CASE reports, signed by a qualified groundwater professional, will include the material requested for within the *Submission Instructions*, including but not limited to:

XIV.J.2.a. The remedy type in place [260.D.1.b.(8).(d)].

XIV.J.2.b. The concentrations of all sampled constituents identified above their respective detection limits since remedy implementation [260.D.1.b.(8).(b)].

XIV.J.2.c. Plume maps showing the lateral and vertical extent of each constituent of concern found at levels above GPS and background [260.D.1.c.(2)].

XIV.J.2.d. Calculated rate of contaminant migration during the CASE period [260.D.1.c.(1)].

XIV.J.2.e. A groundwater potentiometric surface map based on the most recent groundwater elevation data.

XIV.J.2.f. A discussion of the progress during the CASE period toward reaching GPS including any revisions needed to the timelines initially provided in the Corrective Action Plan [260.D.1.b.(8).(c, e, and f)].

XIV.J.2.g. Copies of the field sampling records laboratory reports for all sampling events conducted during the CASE period [260.D.1.b.(8).(g)].

XIV.K. REMEDY COMPLETION DEMONSTRATION

XIV.K.1. *Certificate Submission*
Within 14-days of completing the groundwater remedy, the Permittee shall submit a Certification, signed and certified by the Permittee and a qualified groundwater scientist stating all requirements of 260.H.1 have been met, (a copy of the Certification shall also be placed at the Public Data repository).

XIV.K.2. *CACR Submission*
With submission of the Certification, the Permittee shall submit for approval by the Director, a Corrective Action Completion Report (CACR), signed and certified by a qualified groundwater scientist, demonstrating that the remedial actions have been successful in meeting the requirements Permit Module XIV and 260.C.3.(c).(1):

XIV.K.2.a. Documentation that groundwater protection standards have been achieved at all Performance and Sentinel monitoring points within the plume of contamination beyond the compliance well network established under Permit Module XI during the last three years of groundwater monitoring [260.H.1.a].

XIV.K.2.b. Documentation that groundwater protection standards have been achieved at all Compliance monitoring points at the waste unit boundary during the last three years of groundwater monitoring [260.H.1.a].

XIV.K.2.c. All actions required as part of the remedy have been satisfied or completed [260.H.1.b].

XIV.K.2.d. Documentation that all technical actions and certifications

required to complete the remedy have been satisfied [260.H.2-3].

XIV.K.3. If, after review of the Certification and the CACR, the Director agrees that Corrective Action requirements have been met, the Permittee shall be released from the remedial requirements of 260 and the financial assurance requirements of 9 VAC 20-70-10 et seq. If the Director finds that the presented materials do not substantiate that Corrective Action goals have been achieved, the Permittee shall remain under the Corrective Action requirements until such time as these requirements have been met [260.H.4.b].

XIV.L. REMEDY ABANDONMENT

The Permittee may submit to the Director a Technical Infeasibility Report (TIR) describing the technical reasons why the clean-up objectives cannot be practically met on site using the chosen remedy. The TIR shall be submitted within the timeframe specified in 260.G.3 and include:

XIV.L.1. The certification of a qualified groundwater scientist [260.G.3.a].

XIV.L.2. A discussion of the reasons why the chosen remedy, and any applicable back-up remedy were not successful in meeting the Corrective Action requirements.

If the Director approves of the TIR demonstration:

XIV.L.3. Within 180 days of the Director approval, but no later than 14 days prior to implementing any alternative measures [260.G.3.b], the Permittee shall submit to the Director an Alternate Measures Report (AMR), signed by a qualified groundwater scientist, describing the Alternate Measures to meet the requirements of 260.G.3.d. A copy of the AMR shall also be placed at the Public Data Repository.

XIV.L.4. If, after review of the AMR, the Director agrees that the measures applied to the site meet the requirements of 260.G.3.b, the Permittee shall be released from the Corrective Action requirements and financial assurance requirements of 9 VAC 20-70-10 et seq. If the Director finds that the presented measures do not meet the regulatory requirements, upon the Director's notification, the Permittee shall revise the AMR submission until such time as regulatory conformance is demonstrated.

If the Director disapproves of the TIR demonstration:

XIV.L.5. Within 180 days of the Director's decision, the Permittee shall submit to the Director a revised Corrective Action Plan, signed and certified by a qualified groundwater scientist, describing a new remedy to be applied on site to meet

the requirements of 260.C.3.(c).(1) and shall remain in Corrective Action until those requirements are met.

XIV.M. REMEDY RECORD-KEEPING REQUIREMENTS

XIV.M.1. The Permittee shall record in the facility operating record all actions related to the remedy installed on site, including but not limited to any manifests related to investigatively derived wastes, as well as any design plans, construction reports, as-built documentation, and waste manifests, where applicable.

XIV.M.2. Throughout the life of the Corrective Action Monitoring Program, the Permittee must place on file, in a location accessible to the public, copies of any Corrective Action program materials submitted to the Department including copies of the final Nature and Extent, Presumptive Remedy and/or Assessment of Corrective Measures reports. Consistent with the US EPA's RCRA Public Participation Policy, the location chosen by the Permittee shall serve as the public data repository for all monitoring reports generated during the Corrective Action process and shall in part satisfy the requirements for public participation established under RCRA. The location of the public data repository is listed below.

Location Name: Farmville-Prince Edward Community Library
Location Address: 1303 West 3rd Street
Location City: Farmville, Virginia 23901

XIV.N. CORRECTIVE ACTION NOTIFICATION REQUIREMENTS

XIV.N.1. *System Preparation Update Notification*
During any site preparation phase concerning implementation of a surface water mitigation system, or monitoring well installation phase, the Permittee shall provide written or electronic status updates to the Director every 30 days until such time as the construction of the components is considered complete [260.D.1.b.(8).(a)].

XIV.N.2. *System Component Failure*
Emergency Modification Notification
Within 7 days of noting any Corrective Action remedy component failure, the Permittee shall submit to the Director, a notification describing the cause of the failure [260.D.1.b.(8).(e)].

XIV.N.3. *System Modification*
If modifications other than those described in the Corrective Action Plan are required to correct deficiencies or enhance monitoring system performance

after implementation of the remedy, the Permittee shall submit a written request to the Director for approval of the proposed changes no later than 60 days prior to the date of the proposed modification. The notification must include a description and drawings of the proposed modification; justification for the modification; and evaluation of the performance improvements.

XIV.N.4. *System Design "As-builts"*
Well installation diagrams, boring logs, and the certification required from the groundwater professional shall be submitted as required under 250.A.3.g. As-builts for any other Remedy component which will be installed after remedy implementation should be submitted within 30-days of construction completion.

XIV.N.5. *Miscellaneous Groundwater Notifications*
Notifications regarding new background determinations, GPS exceedances, background exceedances, off-site impacts, dry wells, well abandonment, well installation, etc., must be reported in a manner consistent with requirements of 9 VAC 20-81-10 et seq., unless otherwise defined in this Module.

XIV.O. INVESTIGATIVELY DERIVED WASTES

If applicable, based on the remedy implemented onsite, all investigatively derived waste shall be managed in a manner that is protective of human health and the environment, compliant with all applicable state and federal requirements, and is consistent with the methods outlined in the Corrective Action Plan [260.C.3.(c).(1).(d)].

XIV.P. SURFACE WATER INVESTIGATION

XIV.P.1. Surface water samples shall be collected from locations along the adjacent drainages. At a minimum, the locations shall be situated: at the downgradient 'Plume Discharge Points' (S-1, S-2), and at the downgradient Property Boundary Point (S-3). A point upgradient of the groundwater plume discharge zone is not possible for this site since S-1 is located in the stream headwaters. These locations shall be:

XIV.P.1.a. permanently flagged on site and identified by Global Positioning System coordinates.

XIV.P.1.b. may be augmented by additional sampling locations as needed, based on the results of the surface water sampling program.

XIV.P.1.c. sampled for each GPS exceeding constituent. The parameter list may be modified in the future if the Permittee is required to sample for additional parameters as a result of the issuance of a VPDES Permit.

XIV.P.1.d. sampled at a frequency equivalent to that applied to the sentinel wells.

XIV.P.1.e. sampled in a manner consistent with the QA/QC protocol defined in existing USEPA or USGS surface water guidance.

XIV.P.2. Sampling locations which do not contain a sufficient water column within which to sample will not be required to be re-sampled during the compliance period.

XIV.P.3. If the surface water sampling shows evidence of landfill-derived compounds discharging to surface water on site and/or recognized or potential benthic impairment to surface water on site, the Permittee shall within 60 days, as part of site wide Corrective Action:

XIV.P.3.a. Classify all streams on site as being either 'perennial' or 'intermittent' in a manner which meets Department technical guidance.

XIV.P.3.b. Propose a surface water mitigation plan to address the discharge of groundwater constituents. The facility shall submit a listing of three to four possible conceptual surface water mitigation actions applicable for implementation on site to correct the continued discharge of landfill derived organic constituents and bacterial impairment to the drainage channels. The Permittee may undertake any type of pilot studies as may be needed to help determine the final mitigation choice required. The plan should contain sufficient detail to describe the mitigation system and should note whether coordination with Water Division (or the US Army Corps of Engineers) will be required as part of the mitigation system implementation process.

XIV.P.3.c. Propose a surface water monitoring plan which shall include the sampling and analysis of all GPS exceeding constituents. If the Permittee has to obtain a VPDES Permit as part of the mitigation plan, the sampling parameters of the VPDES Permit will be added to this Module for consistency.

XIV.P.3.d. Implement the approved mitigation and monitoring plans, including coordination with Water Permitting if a discharge Permit is required as part of the final mitigation design and implementation.

XIV.P.4. If the mitigation plans include the use of engineered wetlands, the sampling points can be modified to ensure the wetlands discharge point is monitored.

XIV.Q. PERMIT DOCUMENTS

It shall be the responsibility of the Permittee to update any permit documents as needed. This may trigger Permit modifications.

XIV.R. LIMITATIONS

Should information contained in any Permittee-authored Permit Document conflict with any requirement or condition contained herein, or language found within 9 VAC 20-81-10 et seq., as amended; the Module condition and/or Regulatory requirement shall prevail over the language in the Permittee supplied document unless it can be demonstrated that a variance from that regulatory requirement has been granted by the Director.

When the Permittee becomes aware that he failed to submit any relevant facts or submitted incorrect information in any groundwater monitoring report to the Director, he shall promptly submitted such omitted facts or the correct information with an explanation [530.E].